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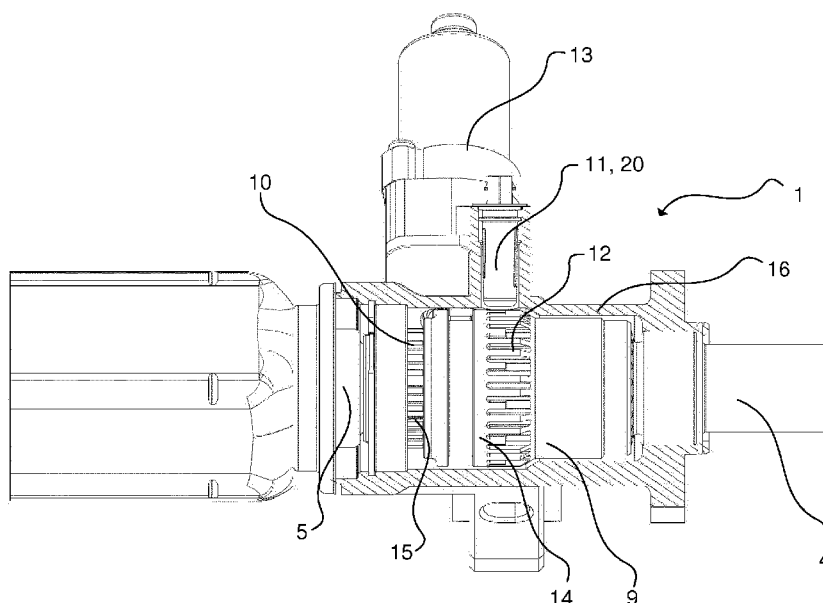


Fig. 3

(57) Abstract: A dog clutch is provided. The dog clutch comprises a sensor system (20) configured to detect both rotational speed and axial position of said axially moveable sleeve (9) by measuring characteristics (12) of the axially moveable sleeve (9).

DOG CLUTCH HAVING A SENSOR SYSTEM

Technical Field

The present invention relates to a dog clutch. More specifically, the invention
5 relates to a dog clutch for a drive system in a vehicle, a sensor system and a method for engaging the dog clutch.

Background

In drive systems for vehicles, especially for vehicles with a drive system
10 configured such that the vehicle can alternate between two wheel drive and all wheel drive, it is desired for fuel consumption purposes that non-driven sections of the drive line can be disengaged/disconnected. This minimizes the number of turning parts in the drive system which are not an active part of the propulsion of the vehicle at any given moment.

15 However, this also generates high demands on the drive line to be able to change between two-wheel drive and all-wheel drive seamlessly and without any disturbing noises from the drive line. A common and economical way to disconnect an unused section of the drive line is to fit a disc clutch at the one end of the section and a dog clutch in the other end. In order to switch from two-wheel drive to all-wheel drive,
20 the disc clutch engages/powers the disconnected section and the dog clutch is engaged subsequently when the disconnected section has gained sufficient rotational speed.

In order to detect when to engage the dog clutch to avoid noise and vibrations, the rate of rotation needs to be measured from both sides of the dog clutch. After engagement of the dog clutch, confirmation is needed for indicating that the dog clutch
25 is properly engaged before normal or full torque is applied by the disc clutch. The confirmation is most commonly attained by another sensor in the dog clutch detecting when the dog clutch is engaged. However, it is undesirable and costly to have a drive line with excessive number of sensors, adding to the complexity of the drive line. Thus, it is sought after a way to minimize the amount of sensors while maintaining or
30 improving the above described functionality of the drive line.

Summary

It is an object of the invention to provide a dog clutch which can alleviate some of the problems with prior art. More specifically, it is an object of the invention to
35 provide a dog clutch comprising a single sensor for detecting both rotational speed and axial movement of components of the clutch such that the number of sensors can be minimized reducing cost and complexity of the dog clutch.

The dog clutch is configured to be operable in a drive system for switching between two wheel drive and all-wheel drive in a vehicle, in which it is desirable to be able to disconnect unused sections of the drive system. The dog clutch is configured to be attached to one end of such a disconnectable section, and a disc clutch is connected
5 at the other end of the section for gradual engagement/disengagement by the disc clutch.

Subject to the present invention is the concept set forth in the appended independent claims; preferred embodiments thereof being defined in the related dependent claims.

According to a first aspect of the invention a dog clutch is provided comprising
10 a first shaft and a second shaft, the first shaft being connected to a first sleeve and the second shaft being connected to a second sleeve, the sleeves being positioned inside a clutch housing. One of the sleeves is moveable in an axial direction of said shafts between an engaged and a disengaged position such that the sleeves are connectable to each other. The clutch further comprises a sensor system configured to detect both
15 rotational speed and axial position of said axially moveable sleeve by measuring characteristics of the axially moveable sleeve. The sensor system comprises a single sensor in the dog clutch for detecting both axial position and rotational speed of the moveable sleeve. This is enabled by providing the moveable sleeve with characteristics detectable by the sensor system and which changes in an axial direction of the moveable
20 sleeve such that axial movement generates varying sensor readings.

According to one embodiment, one of the sleeves is an interior sleeve and the other sleeve is an exterior sleeve, the exterior sleeve being positioned outside the interior sleeve. The relative position of the sleeves enables positioning of splines on each of the sleeves such that only a small movement of the moveable sleeve is required
25 for engagement of the dog clutch.

The axially moveable sleeve may have axially extending circumferential radial projections detectable by the sensor, and wherein the rotational symmetry of the projections varies in an axial direction of said sleeve. The projections protrude radially, such that when the axially moveable sleeve rotates, the sensor is able to detect if a
30 rotational symmetry of the projections changes as the sleeve moves in its axial direction. The rotational symmetry can be changed by e.g. removing a section corresponding to half of the projections axial length from every fourth projection or in several axial variations each indicating an axial position of the axially moveable sleeve.

According to a further embodiment, the rotational symmetry of the projections
35 is varied such that the sensor detects a predetermined rotating projection pattern which varies depending on the axial position of the axially moveable sleeve indicating both rotational speed and position of said moveable sleeve. By creating axially varying

patterns in the projections on the axially moveable sleeve, it is possible to foresee that if a certain pattern is detected by the sensor it corresponds to a certain axial position of the sleeve. Furthermore, the sensor is also able to simultaneously detect the rotational speed of the axially moveable sleeve by measuring pattern repetition or partial pattern repetition.

The dimensions of the projections may vary in an axial direction of said axially moveable sleeve. The sensor is configured to, as with changing rotational symmetry, detect an axial variation of the dimensions of the projections which indicates varying axial positions of the axially moveable sleeve.

The projections may be positioned on the outer circumferential surface on the exterior sleeve, the exterior sleeve being the axially moveable sleeve, such that the projections are detectable by the sensor when the sensor is mounted in the clutch housing. Providing the projections on the exterior sleeve, i.e. the sleeve that is closest to the housing, the risk of generating interference to the sensor can be minimized and the accuracy of the sensing is improved.

The projections may be positioned on the outer circumferential surface of a wheel member connected to and moving with the axially moveable sleeve, such that the projections are detectable by the sensor when the sensor is mounted in the clutch housing. If the projections are arranged on a wheel member, being connectable to the axially moveable sleeve, it is possible to exchange the wheel member to change the characteristics of the clutch. Furthermore, the wheel member facilitates the manufacturing of the projections.

According to a further embodiment, every fourth projection has a shorter axial extension than the remaining projections, the shorter axial extension corresponding to an axial movement of the moveable sleeve such that 2/3 engagement between the first and second sleeves is established when the sensor detects a changed rotating projection pattern. The 2/3 engagement of the clutch indicates that sufficient engagement has been established for the dog clutch being able to transfer torque without being damaged or risking to slip out of engagement. The sensor detects the changed pattern and can thereby detect that sufficient engagement has been reached by the dog clutch.

The width of projections may vary in a predetermined way along the axial direction of the axially moveable sleeve such that the sensor can detect a changing projection pattern as the axially moveable sleeve moves along its axial direction.

The sensor of the dog clutch may preferably be a hall sensor.

The first shaft may be connected to a drive unit via a disc clutch and the first sleeve being connected to the first shaft is axially moveable. Connecting the dog clutch

to the disc clutch creates a disconnectable section of the drive line between the two clutches. Furthermore, the disc clutch is controllable to apply torque in a gradual manner such that full torque only is applied when the sensor of the dog clutch has detected sufficient engagement of the dog clutch.

5 According to a second aspect of the invention a sensor system is provided, being configured to be applied to a drive system distributing torque to the wheels and/or axles of a vehicle. The drive system comprises at least one drive unit, a dog clutch according to the first aspect described above, a disc clutch for connecting the first shaft of the dog clutch to the drive unit. The second shaft of the dog clutch is connected to
10 and rotating with at least one of the wheels of the vehicle. The sensor system further comprises sensors for detecting the rotational speed of the wheels of the vehicle, a sensor of the dog clutch, a control unit being configured to control the engagement of the dog clutch and the disc clutch based on input from at least: the sensor of the dog clutch and the sensor(s) for detecting rotational speed of the wheels of the vehicle.

15 Since only one sensor is required for measuring both rotational speed and axial position of the axially moveable sleeve, the sensor system can be minimized saving costs and complexity. The control unit can be adapted to interpret the rotating projection patterns such that axial positions of the moveable sleeve can be determined simultaneously as the rotational speed is determined.

20 According to a third aspect of the invention, a method for engaging a dog clutch in a system for distributing torque is provided, wherein the method for engaging the dog clutch comprises the steps of S1, in which a control unit is receiving an input signal requesting the connection of the dog clutch. The request to engage/connect the dog clutch may arrive from a engage/disengage unit, arranged to switch between two or
25 all-wheel drive upon request from a user and/or based on information from the vehicle. S2, in which the control unit is engaging the disc clutch in partial engagement, thereby rotating the first shaft connected to the axially moveable sleeve of the dog clutch such that only a small amount of the available torque is transferred to the dog clutch. This allows the dog clutch to engage without risking noise and damage to components of the drive system. S3, in which the control unit is comparing the rotational speed of the first shaft detected by the sensor of the dog clutch with the rotational speed of at least one wheel connected to the output shaft of the dog clutch and when the rotation speed of the axially moveable sleeve reaches within a predetermined range relative to the second shaft, the engaging of the dog clutch starts by axial movement of the axially moveable
30 sleeve. S4, in which the control unit is receiving input from the sensor of the dog clutch during the movement of the axially moveable sleeve and when the input from the sensor to the control unit changes such that sufficient engagement of the dog clutch is

confirmed, full engagement of the disc clutch can be applied for transfer of torque through both the disc clutch and the dog clutch. Due to the axially varying characteristics of the axially moveable sleeve, a single sensor can detect both axial position and rotational speed of the axially moveable sleeve.

5

Brief Description of Drawings

The invention will be described in further detail below under reference to the accompanying drawings, in which

Fig. 1 show a exemplary schematic outline of a drive system for a vehicle in which a dog clutch according to one embodiment of the invention is included,

Fig. 2 is a cross-sectional view of a dog clutch according to one embodiment of the invention,

Fig. 3 is a cross-sectional view of a dog clutch according to one embodiment of the invention,

Figs. 4a-d are schematic views showing characteristics of the sleeve according to various embodiments,

Fig. 5 shows a system for distributing torque according to one embodiment of the invention, and

Fig. 6 shows a method for engaging and disengaging a dog clutch according to one embodiment of the invention.

Detailed Description

With reference to Fig 1, an exemplary schematic outline is shown of a drive system 2 for a vehicle in which a dog clutch 1 according to one embodiment of the invention is included. Fig 1 shows a all-wheel drive system in which the front wheel drive can be connected/disconnected by means of the disc clutch 3 and the dog clutch 1 to attain all wheel drive. However, the present invention is also applicable on an all wheel drive system in which the rear wheels can be connected/disconnected to attain all wheel drive and in other similar configurations for instance with more or less wheels and/or with hybrid electrical drive systems comprising one or several electrical motors.

In Fig. 1, the drive unit 6 comprises an engine and a transmission. The drive unit is connected to a propeller shaft 21. The propeller shaft is directly connected to a rear differential 7 connected to the rear axle of the vehicle. The system further comprises a disc clutch 3 mounted on the propeller shaft 21 and which is connected to a connectable/disconnectable section 22 of the drive system which in its other end is connected to a dog clutch 1. In order to transfer the rotation of the disc clutch 3 to the front axle, a forward differential 7 is also provided. The dog clutch 1 has a first shaft 4

and a second shaft 5, the second shaft being connected to, directly or indirectly, at least one wheel 8 of the vehicle and turning with the same rotational speed as the at least one wheel 8 as the vehicle 2 is in motion. In order to engage all wheel drive, the disc clutch 3 engages the disconnectable section 22 and the dog clutch 1 is engaged subsequently when the disconnectable section has gained sufficient rotational speed such that the first shaft 4 of the dog clutch 1 rotates having essentially the same turn rate as the second shaft 5 of the dog clutch 1. The dog clutch 1 is preferably connected/engaged when the difference in turn rate of the first shaft 4 and the second shaft 5 is in the range of ± 100 -200 rpm to minimize the noise and vibration of the engagement.

Figs. 2 and 3 are cross-sectional views of a dog clutch 1 according to the invention, the dog clutch 1 comprises a first shaft 4 connected to a first sleeve 9 and the second shaft 5 being connected to a second sleeve 10. The sleeves 9, 10 are positioned inside a clutch housing 16 and one of the sleeves 9 is moveable in an axial direction of said shafts 4, 5 between an engaged and a disengaged position such that the sleeves 9, 10 are connectable to each other. The sleeves 9, 10 are configured to be connectable to each other by means of a plurality of axially separated rows of splines 15, such that axial movement of one of the sleeves 9, 10 results in engagement/disengagement of the clutch 1. Preferably, the sleeves 9, 10 are arranged such that one sleeve 10 is an interior sleeve and the other sleeve 9 is an exterior sleeve. The splines 15 are preferably arranged on the interior surface of the exterior sleeve 9 and on the outer surface of the interior sleeve 10.

The clutch 1 further comprises a sensor system 20 having a sensor 11 configured to detect both rotational speed and axial position of said axially moveable sleeve 9 by measuring characteristics of the axially moveable sleeve 9. The characteristics includes axially extending circumferential radial projections 12 detectable by the sensor 11, and wherein the rotational symmetry of the projections 12 varies in an axial direction of said sleeve 9.

The projections 12 may furthermore, alternatively, be arranged on a wheel member 14 connected to the axially moveable sleeve 9. The wheel member 14 allow for easier manufacturing of the projections.

As the axially moveable sleeve 9, shown as the exterior sleeve 9 in Figs. 2 and 3, moves axially and reciprocally between an engaged and a disengaged position, the sensor 11 detects varying characteristics of the projections 12 indicating varying axial positions and thereby confirming engagement and/or disengagement of the clutch 1. As the axially moveable sleeve 9 rotates, the projections generate a periodic pattern that is detectable by the sensor 11. By altering the dimensions and/or the rotational symmetry along the axial length of some or all of the projections, it is possible to detect both

rotational speed and axial position of the axially moveable sleeve 9 using a single sensor 11.

Different embodiments of the characteristics of the projections 12 are shown in Figs. 4a-d. Starting in Fig. 4a, the axial extension of the projections is shown. One row includes projections for which the distance between two adjacent projections is substantially equal to the width of the projection; in the next row, every second teeth is omitted whereby the detected frequency will be different from the first row.

In Fig. 4b the first row is identical to the first row shown in Fig. 4a, however in the second row every fourth teeth is omitted.

In Fig. 4c the first row is similar to the first rows of Figs. 4a-b, however the second row has projections forming teeth having twice the width than the teeth of the first row. Due to this, the distance between two adjacent teeth is doubled.

Fig. 4d shows another embodiment, in which the width of the teeth is increasing from the first row to the second row. Hence, there will be an intermediate portion between the first row and the second row having a continuously increasing width. As can be seen in Fig. 4d, while the width of the teeth is increasing the distance between the teeth is decreasing.

Fig. 5 shows a schematic outline of a sensor system 20 according to one embodiment of the invention. The sensor system 20 is configured for a drive system distributing torque to the wheels and/or axles of a vehicle 2. The drive system comprising at least one drive unit 6 optionally comprising a transmission, a dog clutch 1, a disc clutch 3 for connecting the first shaft 4 of the dog clutch 1 to the drive unit 6. The second shaft 5 of the dog clutch is connected to and rotating with at least one of the wheels of the vehicle 2. The sensor system 20 comprises at least one sensor 18 for detecting the rotational speed of the wheels of the vehicle 2, a sensor 11 of the dog clutch 1 for detecting axial position and rotational speed of the moveable sleeve 9, a control unit 17 being configured to control the engagement of the dog clutch 1 and the disc clutch 3 based on input from at least: the sensor of the dog clutch 11 and the sensor(s) 18 for detecting rotational speed of the wheels of the vehicle 2.

The dog clutch 1 is actuated by an actuator 13, which in turn is controlled by the control unit 17. When the sensor 11 has detected that a sufficient engagement of the dog clutch 1 has been established, i.e. when the rotating projection pattern of the axially moveable sleeve 9 changes to a pattern indication sufficient engagement, the control unit 17 controls the disc clutch 3 to apply the desired torque for changing to all wheel drive mode. In order for the control unit 17 to determine both rotational speed and axial position of the axially moveable sleeve 9 from the single sensor 11 of the dog clutch 1, the pattern generated by the rotating projections is predetermined such that the control

unit 17 will recognize a detected pattern. The rate of repetition, full or partial, of a pattern can be translated to rotational speed comparable to rotational speed from e.g. the wheel sensors 18 of the vehicle and a specific detected pattern translates into a specific axial position of the axial sleeve 9.

5 The engagement of the clutch may be initially requested by an input to the control unit 17 from an engage/disengage unit 19, being triggered either by the vehicle 2 detecting that a specific drive system mode is necessary (i.e. two-wheel drive or all-wheel drive) or a user requesting a specific drive line mode. Upon request from the engage/disengage unit 19, the control unit 17 subsequently controls the engaging or
10 disengaging of the dog clutch 1.

Fig. 6 shows a method for engaging a dog clutch 1 in a drive system for distributing torque wherein the method for engaging the dog clutch 1 comprises the steps of S1, in which the control unit 17 receives an input signal (e.g. from the engage/disengage unit 19) requesting the connection/engagement of the dog clutch 1. In
15 S2, the control unit 17 engages the disc clutch 3 in partial engagement, thereby initiating rotating of the first shaft 4 connected to the axially moveable sleeve 9 of the dog clutch 1 such that only a limited amount of the available torque from the drive unit 6 is transferred to the dog clutch 1. In S3, the control unit 17 compares the rotational speed of the first shaft 4 detected by the sensor 11 of the dog clutch 1 with the
20 rotational speed of at least one wheel connected to the output shaft 5 of the dog clutch 1. When the rotational speed of the axially moveable sleeve 9 reaches within a predetermined range relative to the second shaft 5, the engaging of the dog clutch 1 starts by axial movement of the axially moveable sleeve 9. In the last step, S4, the control unit 17 receives input from the sensor 11 of the dog clutch 1 during the
25 movement of the axially moveable sleeve 9 and when the input from the sensor 11 to the control unit 17 changes such that sufficient engagement of the dog clutch 1 is confirmed, full engagement of the disc clutch 3 can be applied for transfer of torque through both the disc clutch 3 and the dog clutch 1.

CLAIMS

1. A dog clutch comprising a first shaft (4) and a second shaft (5), the first shaft (4) being connected to a first sleeve (9) and the second shaft (5) being connected to a second sleeve (10), the sleeves (9, 10) being positioned inside a clutch housing (16), and wherein one of the sleeves (9, 10) is moveable in an axial direction of said shafts (4, 5) between an engaged and a disengaged position such that the sleeves (9, 10,) are connectable to each other and wherein the clutch (1) further comprises a sensor system (20) configured to detect both rotational speed and axial position of said axially moveable sleeve (9) by measuring characteristics (12) of the axially moveable sleeve (9).

2. Dog clutch according to claim 1, wherein one of the sleeves (10) is an interior sleeve and the other sleeve (9) is an exterior sleeve, the exterior sleeve (9) being positioned concentrically outside the interior sleeve (10).

3. Dog clutch according to any one of the preceding claim, wherein the axially moveable sleeve (9) comprises axially extending circumferential radial projections (12) detectable by a sensor (11) of the sensor system (20), and wherein the rotational symmetry of the projections (12) varies in an axial direction of said sleeve (9).

4. Dog clutch according to claim 3, wherein the rotational symmetry of the projections (12) is varied such that the sensor (11) detects a predetermined rotating projection pattern which varies depending on the axial position of the axially moveable sleeve (9) indicating both rotational speed and position of said moveable sleeve (9).

5. Dog clutch according to claim 3, wherein the dimensions of the projections (12) varies in an axial direction of said axially moveable sleeve (9).

6. Dog clutch according to claim 5, wherein the varying dimensions of the projections results in at least two rows, and wherein a first row comprises teeth having a certain width and being arranged at a certain distance from each other, said second row having teeth of a different width and/or a different distance between each other.

7. Dog clutch according to any of claims 3 to 6, wherein the projections (12) are positioned on the outer circumferential surface on the exterior sleeve (9), the exterior sleeve (9) being the axially moveable sleeve (9), such that the projections (9)

are detectable by the sensor (11) when the sensor (11) is fixedly mounted in the clutch housing (16).

5 8. Dog clutch according to any of claims 3 to 7, wherein the projections (12) are positioned on the outer circumferential surface of a wheel member (14) connected to and moving with the axially moveable sleeve (9), such that the projections (12) are detectable by the sensor (11) when the sensor is mounted in the clutch housing (16).

10 9. Dog clutch according to any of claims 3 to 8, wherein every fourth projection (12) has a shorter axial extension than the remaining projections (12), the shorter axial extension corresponding to an axial movement of the moveable sleeve (9) such that 2/3 engagement between the first and second sleeves (9, 10) is established when the sensor (11) detects a changed rotating projection pattern.

15 10. Dog clutch according to any of claims 3 to 9, wherein the width of projections (12) vary in a predetermined way along the axial direction of the axially moveable sleeve (9) such that the sensor (11) can detect a changing projection pattern as the axially moveable sleeve (9) moves along its axial direction.

20 11. Dog clutch according to any preceding claim, wherein the sensor system (20) of the dog clutch (1) comprises a hall sensor.

25 12. Dog clutch according to any preceding claim, wherein the first shaft (4) is connected to a drive unit (6) via a disc clutch (3) and wherein the first sleeve (9) being connected to the first shaft (4) is axially moveable.

30 13. Sensor system (20) for a drive system distributing torque to the wheels and/or axles of a vehicle (2), the drive system comprising at least one drive unit (6) comprising a transmission, a dog clutch (1) according any preceding claim, a disc clutch (3) for connecting the first shaft (4) of the dog clutch (1) to the drive unit (6), the second shaft (5) of the dog clutch is connected to and rotating with at least one of the wheels of the vehicle (8), wherein the sensor system (20) comprises sensors (18) for detecting the rotational speed of the wheels of the vehicle (2), a sensor (11) of the dog clutch (1), a control unit (17) being configured to control the engagement of the dog clutch (1) and the disc clutch (3) based on input from at least: the sensor of the dog
35 clutch (11) and the sensor(s) (18) for detecting rotational speed of the wheels of the vehicle (2).

14. Method for engaging a dog clutch according to any of claims 1 to 12 in a system for distributing torque according to claim 13, wherein the method for engaging the dog clutch (1) comprises the steps of:

- 5 - receiving an input signal requesting the connection of the dog clutch,
 - engaging the disc clutch (3) in partial engagement, thereby rotating the first shaft (4) connected to the axially moveable sleeve (9) of the dog clutch (1),
 - comparing the rotational speed of the first shaft (4) detected by the sensor (11) of the dog clutch (1) with the rotational speed of at least one wheel connected to the output shaft (5) of the dog clutch and when the rotation speed of the axially
10 moveable sleeve (9) reaches within a predetermined range relative to the second shaft (5), the engaging of the dog clutch (1) starts by axial movement of the axially moveable sleeve (9), and
 - receiving input from the sensor (11) of the dog clutch (1) during the
15 movement of the axially moveable sleeve (9) and when the input from the sensor (11) changes such that sufficient engagement of the dog clutch (1) is confirmed, full engagement of the disc clutch (3) is applied for transfer of torque through both the disc clutch (3) and the dog clutch (1).

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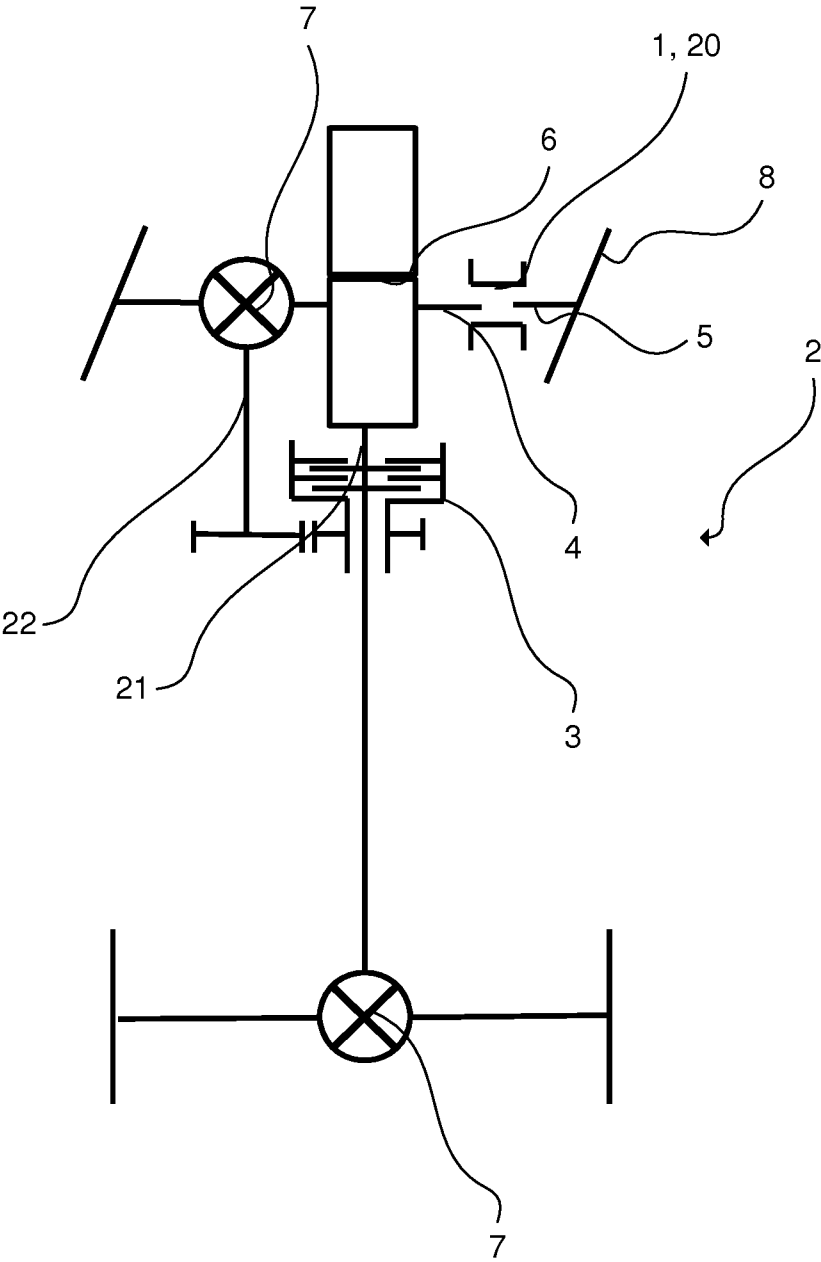


Fig. 1

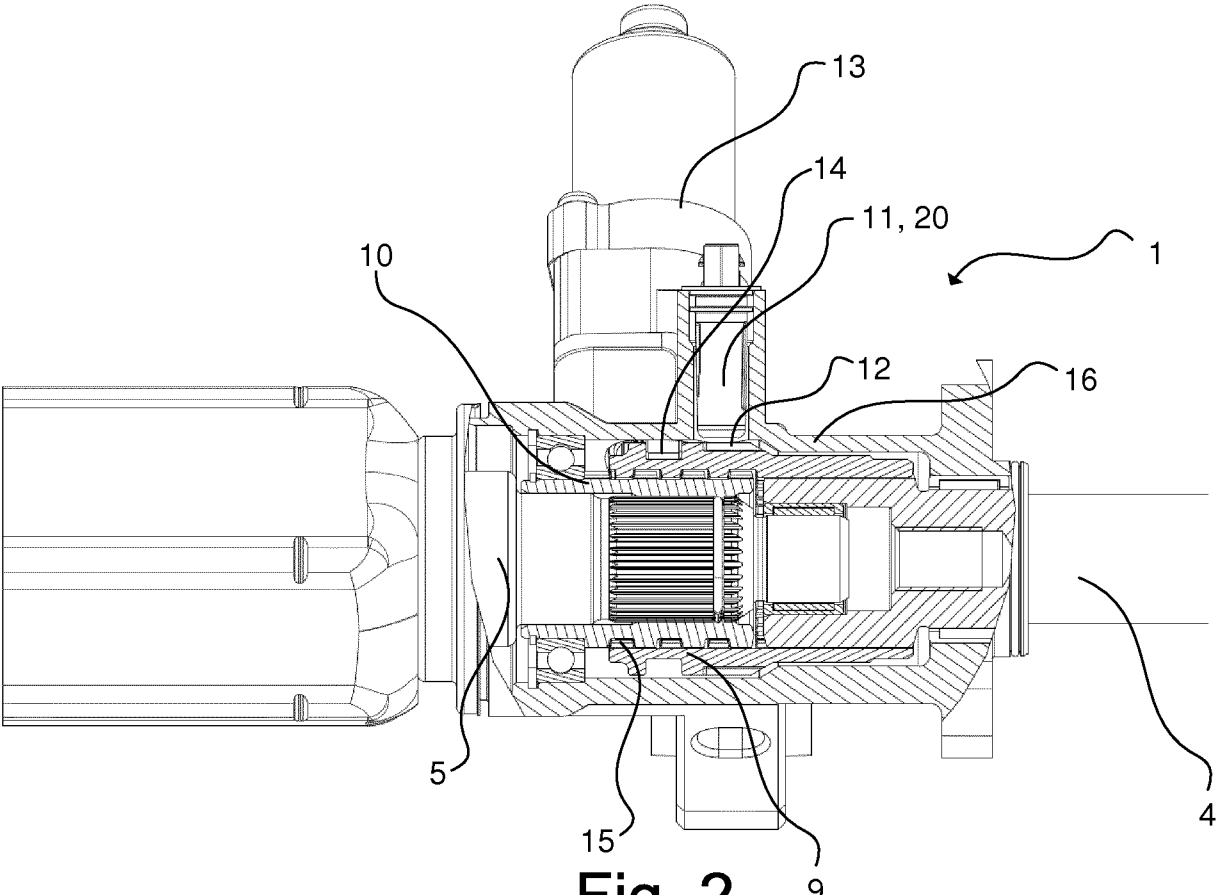


Fig. 2

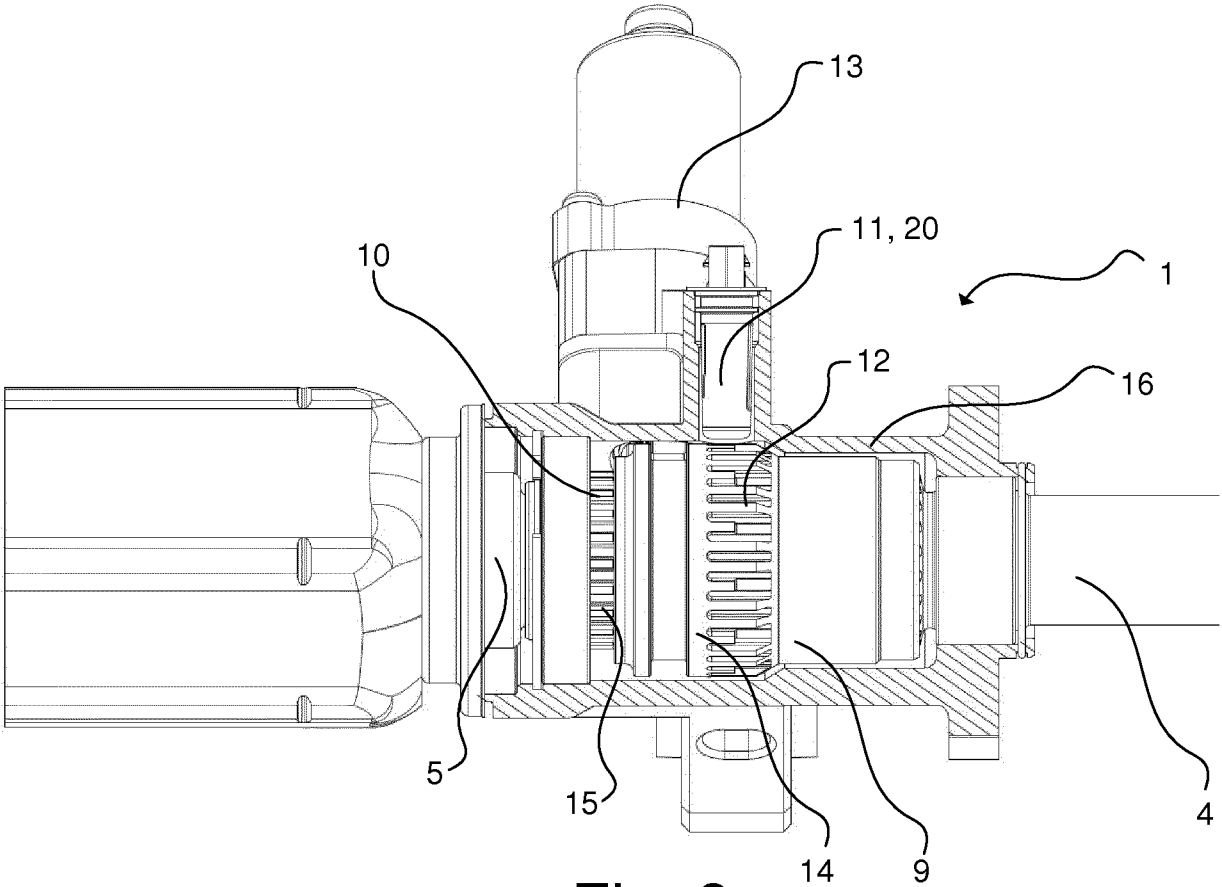


Fig. 3

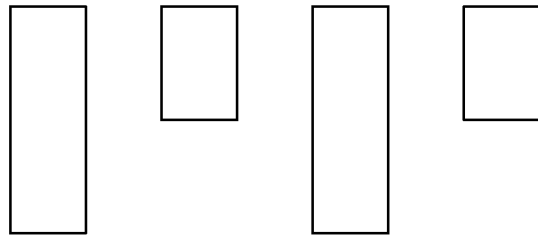


Fig. 4a

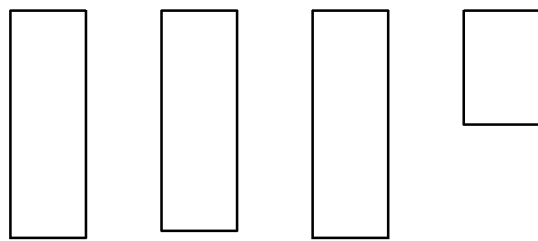


Fig. 4b

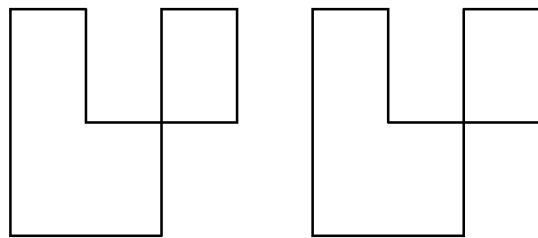


Fig. 4c

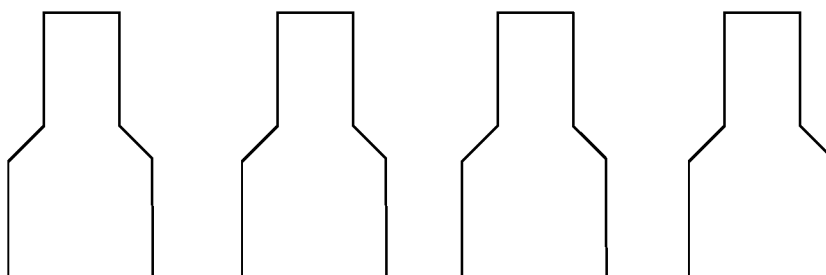


Fig. 4d

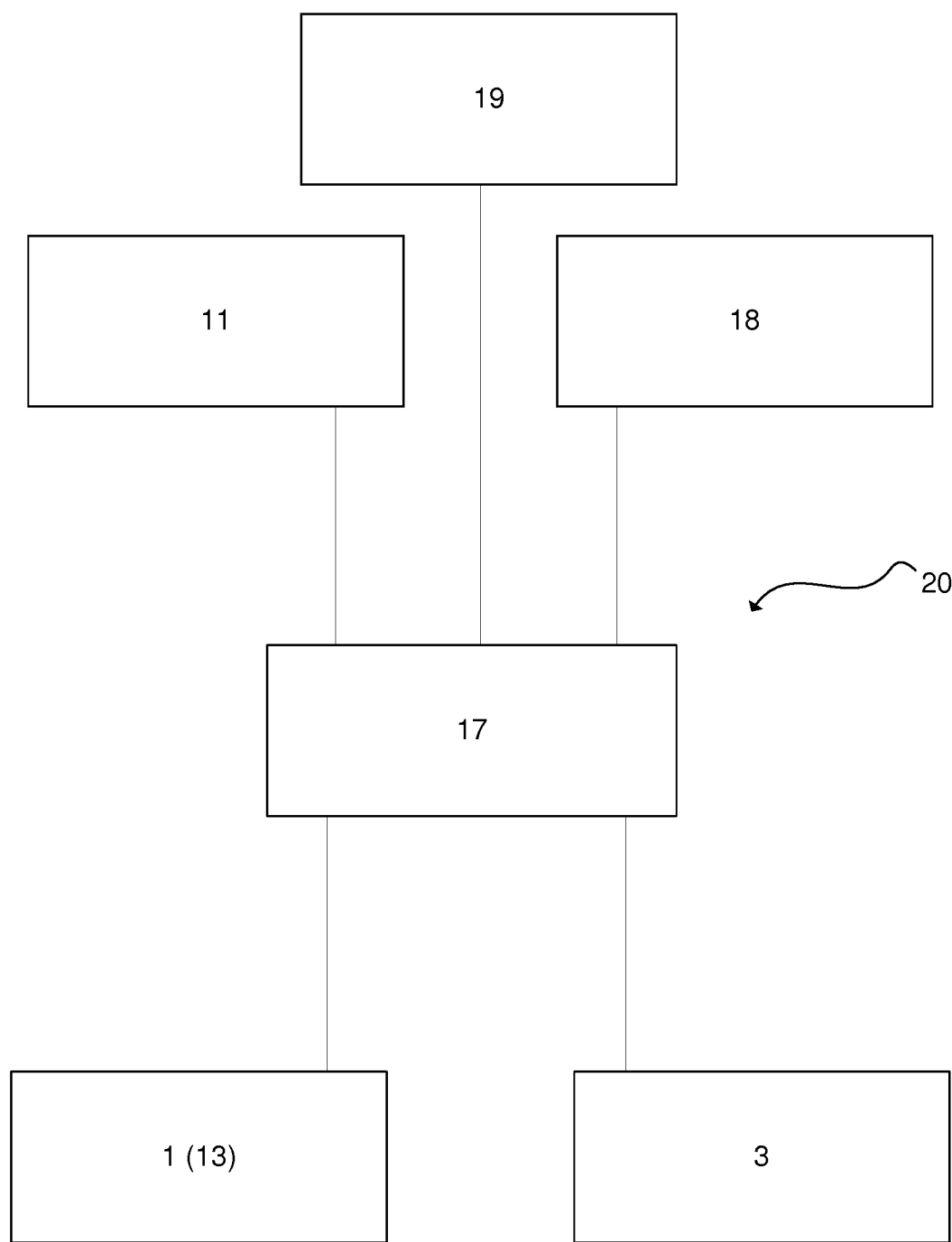
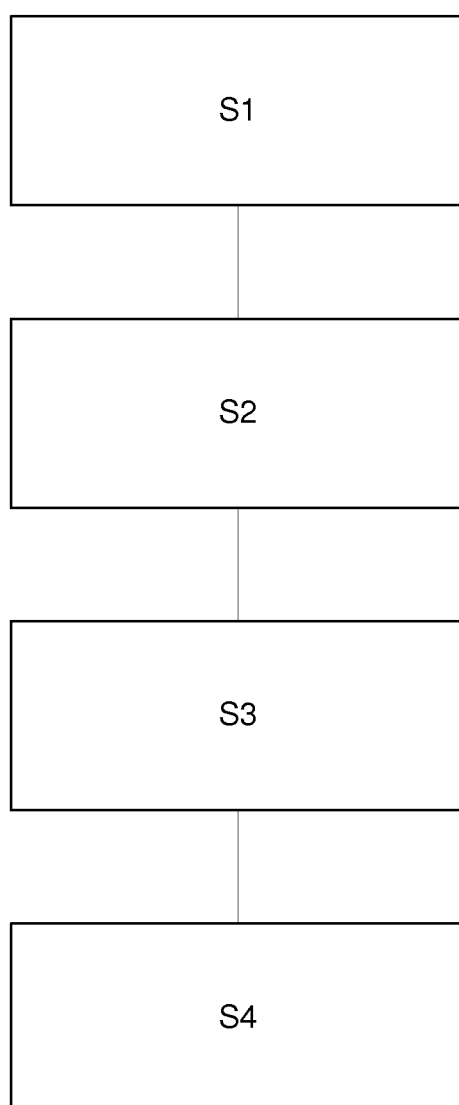


Fig. 5

**Fig. 6**

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2016/063132

A. CLASSIFICATION OF SUBJECT MATTER
INV. F16D48/06
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
F16D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2007/132106 A1 (PEUGEOT CITROEN AUTOMOBILES SA [FR]; GUILLEMARD FRANCK [FR]; BESNARD S) 22 November 2007 (2007-11-22) claims 1,3,6,7	1-3,5,7, 11,14
X	----- EP 2 840 276 A2 (AISIN SEIKI [JP]) 25 February 2015 (2015-02-25) figure 4	1,2,14
X,P	----- DE 10 2014 012591 B3 (WERNER MICHAEL [DE]) 15 October 2015 (2015-10-15) claim 1	1,2,11, 12
A	----- GB 609 389 A (BROCKHOUSE ENGINEERING SOUTHPO; ALBERT LESLIE GATISS) 30 September 1948 (1948-09-30) claim 1	1-14
	----- -/-	



Further documents are listed in the continuation of Box C.



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INTERNATIONAL SEARCH REPORT

International application No

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